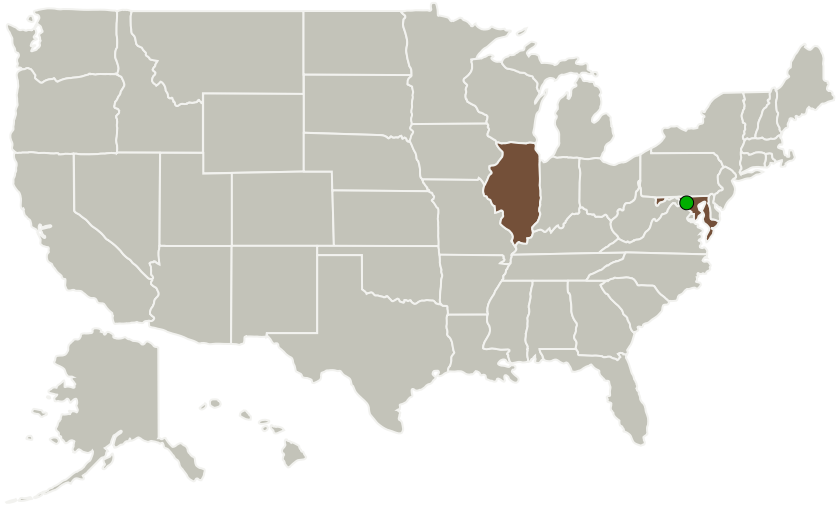
# Advanced Thermal Interface Material Systems for Space Applications, Phase I

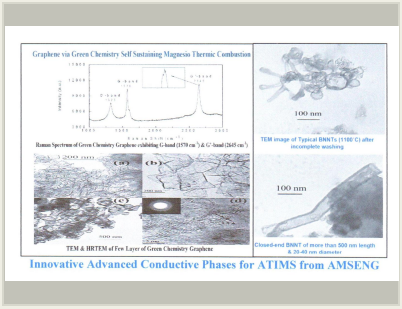
Completed Technology Project (2014 - 2014)

## Project Introduction

The ultimate aim of proposed efforts are to develop innovative material and process (M&P) engineering technology to reduce thermal resistance between space power components and cold plates of the space system. This proposal will use AMSENG produced few layer graphene with carbon nano tubes (CNT) to design and process the Advances Thermal Interface Material Systems (ATIMS) to achieve the performance improvement and to achieve the High Heat Flux capability. An increase in mechanical compliance; increase thermal cycles before degradation and efforts to ensure ease of workability for the engineered TIMS are also planned. The proposed tasks use the innovative engineered Graphene-CNT and High K BNNT - AlN conductive phases with use of AMSENG's innovative ultra low out gassing polymers for space application through the computer assisted thermal interface modeling for guiding the material selection. Our aim is to illustrate gains in cyclic durability at operating temperatures between -55C and 200 C. The proposed concepts have possible potential for providing improvements in peak junction temperature rise, & can yield a several fold improvement in cyclic durability, resulting in desired improvements for the robust space based power systems and spacecraft thermal management components. The proposed efforts are also geared to illustrate four fold increase in thermal conductance in thermal greases and state of the art interface materials and targets achieving > 10C reduction in the junction temperature for the typical heat flux of 50W/cm2. Plans are also presented to conducts experimental evaluation of the M&P engineering concepts that can suggest further maximization of improvements in ATIMS performance when higher flux rates (100 W/cm2) are involved.

## Primary U.S. Work Locations and Key Partners






Advanced Thermal Interface Material Systems for Space Applications Project Image

## Table of Contents

**Small Business Innovation Research/Small Business Tech Transfer**

# Advanced Thermal Interface Material Systems for Space Applications, Phase I

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Applied Material Systems Engineering, Inc. (AMSENG) | Lead Organization | Industry Small Disadvantaged Business (SDB) | Schaumburg, Illinois |
| Goddard Space Flight Center(GSFC) | Supporting Organization | NASA Center | Greenbelt, Maryland |

| Primary U.S. Work Locations | |
|---|---|
| Illinois | Maryland |

## Project Transitions

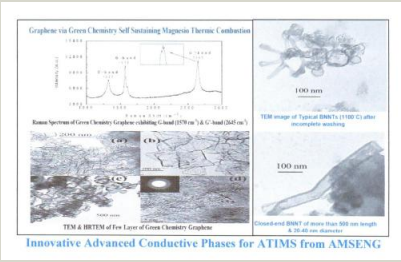
**June 2014:** Project Start

**December 2014:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/137535)*

## Images




**Project Image**
Advanced Thermal Interface Material Systems for Space Applications Project Image *(https://techport.nasa.gov/image/128329)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Applied Material Systems Engineering, Inc. (AMSENG)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

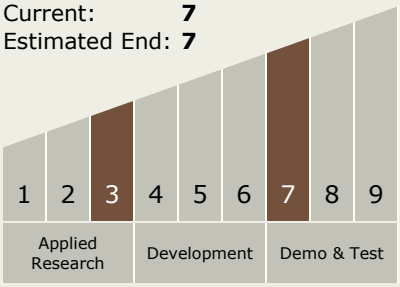
Carlos Torrez

**Principal Investigator:**

Mukund S Deshpande

## Technology Maturity (TRL)

Start: **3**
Current: **7**
Estimated End: **7**



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## Technology Areas

**Primary:**

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.2 Heat Transport

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System